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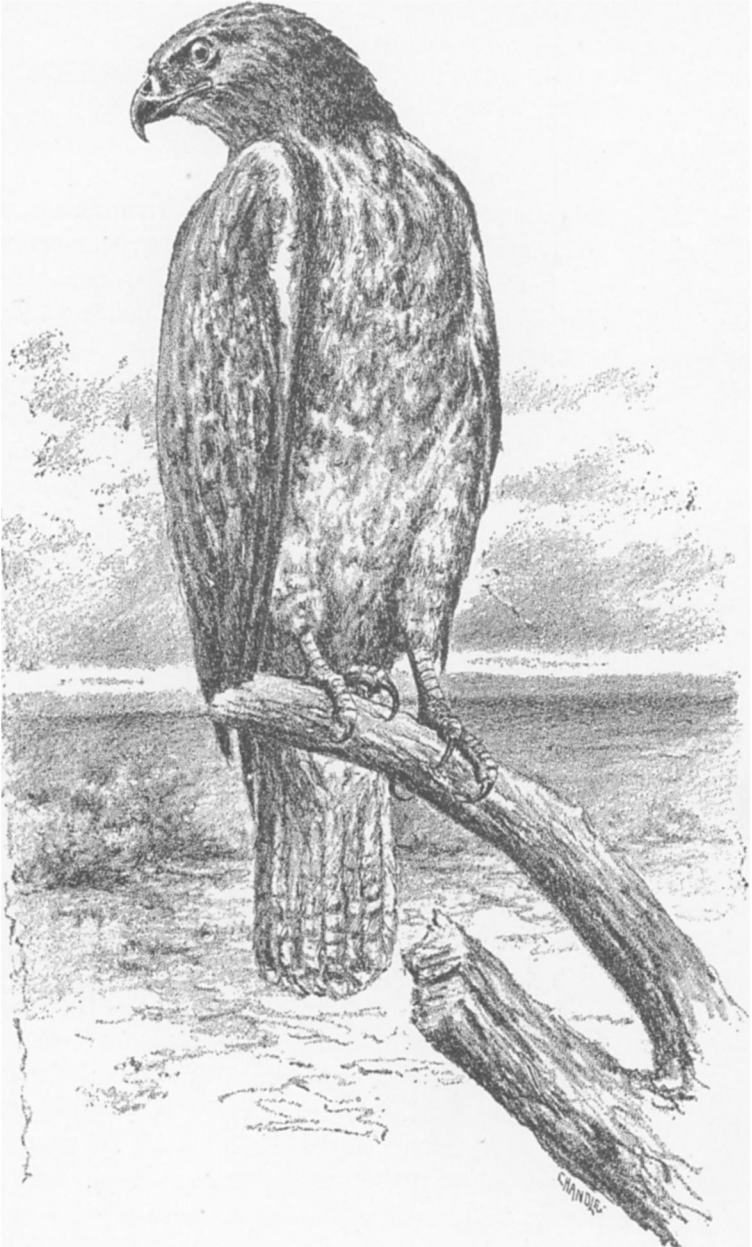
WHERE YOUNG AMATEUR PHOTOGRAPHERS CAN  
BE OF ASSISTANCE TO SCIENCE.

BY DR. R. W. SHUFELDT.

OF all the instruments that have come into use in the hands of science during the latter part of the present decade, none of them have been found so universally helpful as has been the camera. The photographic camera, with its modern multitudinous appliances, has made its power felt in the greatest variety of ways in all the departments of science, as in physics, chemistry, mechanics, astronomy, zoology, and each and the rest. But it is not my object to present an historical essay here upon this instrument, nor even to make the attempt to write out all I know about the operating of one in its details; it is merely my aim to bring a few practical hints before young photographers, and show them some of the new fields wherein, by patience and study, they can put their instruments to very excellent uses. As we all know, the art of photography is now easily acquired, and the producing of photographic pictures a pleasurable and sometimes a profitable employment. Yet how often it is that we see a young person purchase a first-class camera with its entire outfit, and after coming to be a good photographer, is satisfied at the end of a year or so with having filled a large album with pictures of the country around about his or her place of residence, or groups of friends, and perhaps a few other subjects, when the whole, save the album, is relegated to a corner in the garret. This is by no means a rare occurrence and the end of such enterprises.

I am a working naturalist, and a number of years ago conceived the idea that a good photographic outfit would meet a variety of ends in the course of my labors. A hundred dollars gave me one, and three times that amount of money would not induce me to part with it now. Including all my early failures, more than fifty per cent. of my pictures, and there have been a great many of them, have been published as illustrations to my scientific papers, and elsewhere.

PLATE XIII.



THE WESTERN RED-TAILED HAWK (*Buteo borealis calurus*). From a photograph.

When one comes to examine the figures of mammals, birds, reptiles, fish, and other forms that illustrate many of our older works in zoology, he can be but struck with the fact how wide of the mark the majority of them are. Indeed, it is frequently difficult to recognize the form of the animal that the artist intended to depict from the drawing he has made of it.

It was along such lines, as well as others nearly related thereto, that I hoped to introduce an improvement into my own designs. So simple are these steps that I feel sure that any painstaking young photographer can acquire and practice them,—and that, too, to profitable ends; to his personal enjoyment in the pursuit; or to the great assistance of others; or even to the advancement of learning; possibly to all of these combined.

A year or so ago I was collecting zoological and ethnological material in Northwestern New Mexico, and among many other things captured a great number of tiger salamanders (*Amblystoma tigrinum*), which were sent to biological laboratories all over the world. Now a salamander is a difficult subject to get a good figure of, and there are comparatively but few such throughout the entire range of zoological literature. This was my way of obtaining one with the camera: I fixed a small pine shelf perpendicular to the wall of my study at a convenient distance above the floor. This I covered with a large sheet of clean, white blotting paper, bending it so it hung down over the shelf in front, and likewise extended up over the wall behind. It was held in place by pinning it to the shelf with artists' thumb-tacks. Next placing any long, small object on the middle of the shelf in the place to be afterwards occupied by the salamander, we focus upon it with the camera, a strong light coming directly from behind the instrument. Insert your diaphragm with the smallest aperture, and remove the "dummy" from off the shelf. Now we are ready for the subject, and as it is very difficult to get one of these animals to lie still an instant, I waved over his nostrils, for a second or two, the fumes of a little sulphuric ether, and placed him in position on the shelf. As he recovered from the anæsthetic, he assumed a very natural attitude, and was perfectly quiet, allowing me to make an exposure of two minutes, and the



FIG. 1. — The Tiger Salamander (*A. tigrinum*); life size.

result was I obtained a good working negative.<sup>1</sup> The object of the blotting paper is to give a sharp figure, bereft of all surroundings, and that is one kind of picture largely demanded in zoological illustrations. Of course we *can* have all the grass, stones, and the rest of it that we want, but, as I say, that is not the kind of figure desired. The nap on the blotting paper usually gives a peculiarly soft background, and dead white in the reproduction made from the negative.

In nearly all cases such a negative should be *intensified* by the usual method with bichloride of mercury and the ammonia bath. It sharpens all the details of the figures, and makes a better print for the object in view. Now from such a negative a good photograph can be made upon sensitized albumen paper, and from this a drawing can be made. Or, any of the photo-engravers, by the various methods now employed, can make an electrotype from this negative, from which any number of figures can be printed. Yet again, you can make a print from it upon plain, non-albumenized, sensitized paper, which figure can be afterwards colored by hand from the original, and then handed to a lithographer for reproduction. Finally, one of the prints on this plain paper, can be delicately traced over by means of one of Gillott's mapping pens (No. 291) and Higgins' American drawing ink, and, when dry, the print can be submitted to a bath of saturated corrosive sublimate, and removes everything save what you have traced with your drawing ink. The "black and white" figure thus produced can be electro-

<sup>1</sup> Had not this negative, and the one described beyond of the Buteo, been broken just prior to having good prints made from them, they could have been used in the repro-

typed by any of the ordinary methods, at a very moderate cost, and it will make a fair figure to illustrate what the young naturalist may have to say in the journal he subscribes for,—as, for instance, the reports of any of the many chapters of the Agassiz Association to President Ballard. Excellent figures of fish may be obtained by any of the above methods, if you will but go to the trouble of constructing a glass tank of clear panes of window-glass, say 10x16, but only an inch or two apart, and parallel. In such a tank, filled with the very clearest of water, your ordinary-sized fish will be kept constantly in position and quiet. You can photograph through the double glass and the water, but you must only have the sky behind it for a background. To get an animal life-size you measure it with a pair of compasses, and compare this measurement with the image on the ground-glass of the camera, after you have finally focused to your liking. Your best stock of patience will be demanded in the photography of living birds. An entire chapter might be written upon this branch of the subject, and then it would hardly be exhausted. The same scrupulous care must be exercised in reference to position, the accessories, the backgrounds, and the rest of it. Very often we get excellent pictures from slightly wounded birds, and this was the case with the specimen of the Western Red-Tailed Hawk here offered in illustration. I made the photograph of this specimen in New Mexico in 1888.

It will be seen that I selected a rugged pine stump for him to stand upon, and this perch was sharply focused before placing my subject upon it. Further, it must be noticed that I secured a horizon; in other words, the hawk is brought out in strong relief against a good sky, which occupies the upper half of the figure. It would have been a simple matter to have placed a dead bird under one of his talons, but it was not done in this case; I have

duction of "half-tone" process figures. As it was, however, I had only secured prints fixed by hyposulphite of soda. So with the pentagraph. Mr. W. H. Chandlee, the artist of the U. S. National Museum, made the very accurate and beautiful drawings from them which illustrate this article. But even this method (in which the camera plays an equally important part) is as fully as useful, and one often resorted to by the artist who desires to obtain accurate and artistic illustrations in zoology. On this point see the author's letter to the editor in *The Auk* for April, 1891, entitled "Camera Notes for Ornithologists."

figures of owls wherein I have accomplished it. Where no background is demanded, such birds can be photographed in one's study, with a white sheet behind them, and against this cone-bearing pine boughs, old stumps, and the like, come out beautifully, and elegant figures of many kinds can be reproduced from the negative thus secured. A pneumatic snap-shutter is almost an indispensable adjunct to your camera in the proper photography of birds, as some of them have to be partially hypnotized before placed in position to be taken. Then, as they recover from the effect of this, they dress their plumage, assume a natural posture, and then appear animated. You now watch your opportunity, and secure an instantaneous picture of your feathered subject. In the forest you can often get most valuable negatives of nests and similar objects, all of which are highly prized by the scientific naturalist, and can be used in his work. Large lizards, such as our "Gila Monster" of Arizona, I have obtained by firmly strapping my camera in such a manner as to have the line of the focal axis perpendicular to the floor, upon which I have placed a sheet of white blotting paper, and then allowed the reptile to walk over it, and as he came beneath the lens, I secured a first-class negative of him. In the case of mammals, I have obtained photographs of dead ones, placed in natural postures, so faithfully done that they deceived the eyes of the best experts afterwards. My badger, published in *Forest and Stream* several years ago, was taken in that way, and very numerous other subjects, both since and before it.

The field and line of work I have briefly indicated above, is brimful of interest for the enthusiastic young naturalist, and one wherein he will soon find that all his ingenuity will be most amply demanded. As every faithful young biologist should keep his "journal" of observations made afield, and in the forest, or afloat, he will very soon find that his camera will aid him immensely in affording the means of furnishing permanent pictures wherewith to illustrate his remarks, and these in addition to the ones used from which his photo-electrotypes have been selected for printing.